

Photodiode as current source

Student Group

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Fig. 1: Inverting Op-Amp: Photodiode BPW 34 S



Fig. 2: Inverting Op-Amp: Diagramms of BPW 34 S



Fig. 3: Inverting Op-Amp: Photo Diode as current source

$$U_{DD} \approx 10\text{V}, U_{SS} \approx -10\text{V}$$

We assume a good illuminated room of 300 lx, illuminated by a white LED. White light is a mixture of many wavelengths across the visible spectrum, roughly 380 to 780 nm. For a typical white LED, the spectrum usually comes from a blue LED chip with a peak around 450 nm, plus a broader phosphor emission that spreads across green, yellow, and red wavelengths. For an easier calculation, we take a mean value of 500 nm which is close to the peak value of the blue LED (in reality a greenish light) and 300 lx for the illumination.

The graph in figure 2 shows that the photodiode sensitivity at 500 nm is only 30%. The maximum current (100%) at 300 lx is 30 μA .

We can now estimate the current we would expect from the photodiode at 300 lx:

$$I_1 = 30\ \mu\text{A} * 0.3 = 9\ \mu\text{A}$$

$$I_1 \approx 10\ \mu\text{A}$$

30% of 30 μA is roughly 10 μA .

We will assume a current of 10 μA at 300 lx for our calculations.

Complete the arrows in the schematic of the circuit in figure 3.

Calculate R_2 so that $U_{OUT} = 5\text{V}$ at 300 lx. Take a resistor from the E6 series that is as close as possible to the calculated value.

Also fill in the values for I_1 , I_2 , U_{OUT} and U_2 .

$$I_1 = \text{?}$$

$$I_{R2}$$

$$U_{OUT}$$

$$U_{R2}$$

$$R_{R2}$$

What value would you expect for U_D and why?

$$U_D$$

$\{ \dots \}$

$\{ \dots \}$

$\{ \dots \}$

$\{ \dots \}$

$\{ \dots \}$

$\{ \dots \}$

What value would you expect for U_{D} at 300 lx when it is not connected to the Op-Amp or any other electronic component (open-circuit voltage) and why?

$U_{\text{D}} \approx$

$\{ \text{rm} \dots \}$

$\{ \text{rm} \dots \}$

$\{ \text{rm} \dots \}$

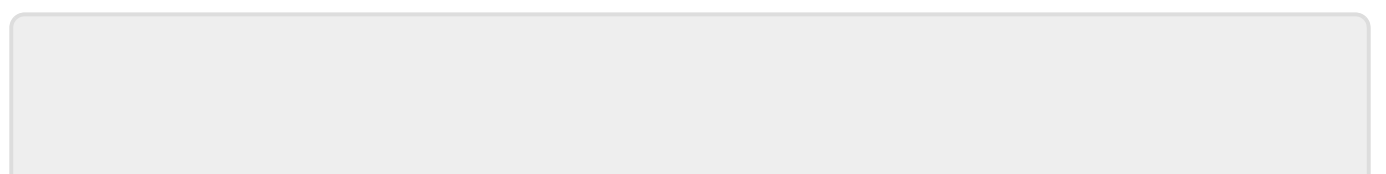
$\{ \text{rm} \dots \}$

$\{ \text{rm} \dots \}$

$\{ \text{rm} \dots \}$

| Illumination | U_{OUT} ... | U_{1} ... | U_{2} ... | U_{D} ... | U_{D} ... |
|--------------|----------------------|--------------------|--------------------|--------------------|--------------------|
| dark... | | | | | |
| 300 lx... | | | | | |

Tab. 1: Photodiode measured values



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